DOCUMENT RESUME

ED 077 386 HE 004 190

AUTHOR Shoemaker, William A.
TITLE Systems Models and Programs for Higher Education. A Catalogue.
INSTITUTION Academy for Educational Development, Inc., Washington, D. C. Management Div.
PUB DATE Apr 73
NOTE 25p.
AVAILABLE FROM Management Division, Academy for Educational Development, Inc., 1424 Sixteenth Street, N. W., Washington, D. C. 20036 (Single copies free)

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Administrator Guides; *Decision Making; *Demonstration Programs; *Educational Administration; *Higher Education; *Management Information Systems; Management Systems

ABSTRACT

In recent years there has been considerable effort devoted to the development of systems models and programs that would assist college and university administrators in obtaining and analyzing data about internal operations. Such management data presumably would be helpful in decisionmaking. In this document an effort has been made to provide a brief summary of those systems approaches that have been identified as being oriented toward use by colleges and universities. Particular models described include: (1) the On-Line Administrative Information System (OASIS); (2) TOTAL; (3) The Administrative Information Distribution System (AIDS); (4) MARK IV; (5) The National Center for Higher Education Management Systems (NCHEMS); (6) the Comprehensive Analytical Methods for Planning in University Systems (CAMPUS); (7) System for Evaluating Alternative Resource Commitments in Higher Education (SEARCH); (8) the Higher Education Long-Range Planning/Planning Translator (HELP/PLANTRAN); (9) the Cost Estimation Model (CEM); (10) Temple University's TEMPLAN; (11) Administrative and Organizational Systems/National Laboratory for Higher Education (AOS/NLHE); and (12) the College and University Systems Exchange (CAUSE). (HS)

ED 077386

# SYSTEMS MODELS AND PROGRAMS FOR HIGHER EDUCATION

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL OFFICE OF EDUCATION POSITION OR POLICY.

A Catalogue

HE 004 190

by
WILLIAM A. SHOEMAKER
Council for the Advancement of
Small Colleges

MD
MANAGEMENT DIVISION
ACADEMY FOR EDUCATIONAL DEVELOPMENT

APRIL, 1973

FILMED FROM BEST AVAILABLE COPY

ED 077386

# SYSTEMS MODELS AND PROGRAMS FOR HIGHER EDUCATION

A CATALOGUE

by

WILLIAM A. SHOEMAKER
Council for the Advancement
Of Small Colleges

Academy for Educational Development, Inc.
1424 Sixteenth Street, N.W.
Washington, D.C. 20036
April, 1973

# FOREWORD

Recently I learned that Dr. William A. Shoemaker, on the staff of the Council for the Advancement of Small Colleges, had carried on an extensive study of model systems and other procedures designed to improve the management of colleges and universities. In the process of conducting this study, he had identified and described a number of computerized and other systems designed to provide management information and to facilitate management planning procedures.

It seemed to me that it would be useful for college and university presidents and their associates to have readily available a brief description of the various model systems and other programs developed for their benefit. Accordingly, I requested and obtained permission to publish a part of Dr. Shoemaker's study in this particular format.

Dr. Shoemaker wishes to make it clear that he has not endeavored thoroughly to evaluate the relative merits of the various model systems and procedures catalogued here. A careful assessment of the actual achievements and of the weaknesses in these various systems would have required a much more extensive effort. Hopefully, others can and will provide the basis for a fair assessment of the utility, benefits, failures, and costs inherent in each of the systems reported herein.

This pamphlet then must be regarded as a beginning, as a first step in reviewing the management information needs and management planning aids for a college or university.

Since Dr. Shoemaker's study was completed, several additional systems have come to my attention. One is a Space Planning and Cost Estimating (SPACE) simulation model developed by two men in the Office of Analytical Studies at the University of California. This model is designed to permit an analysis of alternative patterns of class scheduling and their impact upon available space resources. A similar kind of management information system is the Institutional Space Inventory Techniques (INSITE), developed at Massachusetts Institute of Technology. During 1972, it was extended in its application to a consortium of three other private universities in the northeastern area of the United States.

Still another advanced computerized planning system was announced early in 1973 by Brooklyn College of the City University of New York. This Higher Education Planning System (HEPS) is expected to provide a wide range of planning data on such matters as future program loads, class sections, space needs, space scheduling and other requirements, based

upon projected enrollments. The system utilizes data banks on students, staffing, courses, physical facilities, and expenditures.

In addition, the Department of Health, Education, and Welfare, in October, 1972, announced that they had contracted the Inner City Fund of Washington, D.C., to develop a computer model for the preparation and analysis of program budgets for institutions of post-secondary education. This model, labelled EDANAL, was described as relatively simple to use and inexpensive to operate. The model requires input data on instructional programs, teaching loads and salaries, the allocation of faculty time, and overhead costs.

All of these developments occurred subsequent to Dr. Shoemaker's study. They are mentioned here simply to point out that this is a developing field of activity and that some final form of model simulation has not yet been accomplished, if, indeed, some final form is desirable.

This pamphlet will serve its purpose if it accomplishes one of two objectives: (1) to provide information to administrative officers of colleges and universities about the variety of information and planning systems available to them and (2) to provide information to others about the extent to which sophisticated techniques of management information and planning are now available for management improvement within higher education.

John D. Millett
Vice President and Director
Management Division
Academy for Educational Development

# SYSTEMS MODELS AND PROGRAMS FOR HIGHER EDUCATION

## Introduction

In recent years there has been considerable effort devoted to the development of systems models and programs which would assist college and university administrators in obtaining and analyzing data about internal operations. Such management data presumably would be helpful in decision-making. To a considerable degree these models and programs represent an extension of an idea, promulgated several years ago, of ten-year or long-range advanced planning. Most of the new approaches are intended to make use of new capabilities in data processing provided by present day high speed electronic computer equipment, though a few are "paper and pen" oriented.

The very variety of systems models and programs available to higher education administrators and competing claims about their usefulness have tended to confuse the whole issue. The fact that these models and programs make use of new resources may also be confusing; they rely upon the concepts and language of systems theory and make use of new systems-related tools and techniques. At the same time, these devices offer a more extensive synthesis of data and a broader perspective than has previously been available. Consequently, new insights into and understanding of the structure, dynamics, and variety of circumstances of many different colleges and universities are now possible.

In their approach to the possible utilization of systems models and programs as analytical tools, the research universities and the comprehensive universities have enjoyed substantial advantages over the smaller comprehensive colleges, liberal arts colleges, and specialized professional schools. The universities generally have had computer centers located on their campuses and staffs competent to plan, program, and operate data collecting and analyzing activities. In the smaller colleges there have often been less ready access to computer equipment and less staff capability in making use of such equipment. But administrative officers of both universities and colleges have expressed the need for some kind of "consumer's guide" to systems models and programs for studying their own operations.

In this present account an effort has been made to provide a brief summary of those systems approaches which have been identified as being

particularly oriented toward use by colleges and universities. It has not been possible to evaluate the effectiveness or efficiency of each model or program. The catalogue is as inclusive as was possible upon the basis of available literature, personal contacts, and various referrals by higher education personnel. Many systems were excluded from mention because the design was suitable only for a research university, because the design was primarily intended for a multi-campus institution or a state-wide system, because the design was suitable for only one area of operation (such as registration, student record keeping, accounting and fiscal reporting, or alumni records), or because the approach was less comprehensive than that provided in the models mentioned here.

In the course of this study, it became clearly evident that systems models available to colleges and universities are designed to perform quite different tasks. There appear to be six major purposes which can be served by systems models and programs, although no one model will necessarily serve all six purposes:

1. **Management Information Systems for Current Operations** collect and utilize data needed to provide information and control over daily or periodic transactions such as cash balances, payroll records and disbursements, alumni contributions, student grades, etc.

2. **Management Information Systems for Planning** organize and analyze data needed for long-range planning and for projecting goals, needs, and procedures, such as the cost of various instructional programs, the cost of various enrollment levels, the cost of instructional procedures, and the resource allocation required to support such projections.

3. **Simulation** emphasizes the interrelationship in the quantifiable factors of higher education which will result from various assumptions about the learning environment, such as enrollment growth or decline, changes in instructional procedures, changes in faculty composition and compensation, overhead costs, etc.

4. **Procedural or Process Models** attempt to use PERT techniques to organize and structure the flow or process of decision-making and planning to encompass all essential steps in a time-flow sequence, including consultation with interested groups, decision-making, and resulting action.

5. **Comprehensive Tailored Models** define the specific needs of a particular college or university and then apply one of several different models to the development of projections or simulation appropriate to that institution.

6. **Exchange Services** serve as clearinghouses for the exchange of information about computer programs developed in particular colleges and universities and encourage systems applications by promoting an exchange of actual computer programs.

## On-Line Administrative Information System (OASIS)

An Information Network for Operations (INFO) project has been under way for several years at Stanford University with some financial assistance from the Ford Foundation. The activity is known as Project INFO and has been housed on the Stanford campus. The project has produced the design but only the partial implementation of the On-Line Administrative Information System (OASIS).

OASIS is a management information system for data related to current operations. Ultimately, the model may incorporate a planning function, but, up to 1972, the purpose has been to develop and use an integrated data base for information and control of daily operations.

The goal has been to provide department chairmen, program directors, and top-level administrators with data compiled, compared, and analyzed for their information. The system is built on the aggregate of files from various university offices. Terminals may be installed in offices and can be operated by non-technical personnel. The system is expected to produce reports "tailored" to the departmental or administrative need. An office may ask about information on file and obtain a report at a terminal, either as a display on a cathode ray tube or as a print-out. The system requires at least a medium-sized computer and rather high-cost remote terminal units. Such equipment would be feasible for a small college only on a shared-time or consortium basis.

A special feature of OASIS is its rather elaborate, complex system of security provisions to prevent unapproved access to information. Blocks in access to data have been built into the system and can be removed only by using appropriate codes.

OASIS has not been intended for the exclusive use of Stanford University, and some of the support funds have been earmarked for experimental installation in other institutions. The program for the system is in the public domain and is available to other colleges and universities.

## TOTAL

TOTAL is a proprietary computer software program which a college or university can use to compile, store, and retrieve information related to the operation of the institution. It was developed by CINCOM Systems in Ohio.

An integrated, data based management information system, TOTAL is concerned primarily with daily operations. The data could be designed to be NCHEMS compatible, to permit use of the NCHEMS planning program on the same data base.

The data base includes information from such diverse areas as students, alumni, gifts, accounting, personnel, and physical plant. Every element in the data base can be related to any other element or all other elements regardless of the source of the original input. In this way, administrators may draw their own conclusions about interrelationships.

Departmental files can also be maintained and security preserved through the program. TOTAL permits the data to be network structured rather than hierarchically structured. The data base can be changed, the structure altered, and new information linkages created as they are needed for analytical purposes. The program can employ several computer languages and can be operated on computer equipment produced by several different manufacturers.

Several colleges and universities, as well as 200 or more industrial and commercial users, currently are using the program. Start-up time will vary, depending upon the present methods of handling data. Anywhere from a few days to nine months might be necessary to implement the system. The purchase price for the basic computer program has been $22,500; the program may be rented for $750 a month. Several technical people would be needed to operate the system, including analysts and programmers.

TOTAL did not, as of 1972, include an on-line capability; that is, immediate two-way interaction between computer and user. Moreover, a reporting capability had not been built into the model as of 1972. CINCOM reports that it has been working on both of these features. Essentially, TOTAL has been simply a program for processing extensive operating data by means of a computer.

**Administrative Information Distribution System (AIDS)**

AIDS is a management information system developed and utilized at Portland State University in Oregon, with the assistance of the management consulting firm of Cresap, McCormick, and Paget.

In the development of AIDS, three particular management principles were set forth to be served by the system. These were:

1. Management by Objective
2. Management by Exception
3. Management by Perception

AIDS is intended to identify major objectives of the institution and provide periodic review of the progress realized in efforts to accomplish those objectives. In addition, the system is expected to establish adequate planning and operating procedures, so that management attention can concentrate on situations evidencing some failure or inadequacy in performance. And it is intended that all levels of management in the university should have access to all relevant current and historical data about their operations.

The system is designed to be simple, manual, modular, and evolutionary. The data base includes information about students, finances, faculty, personnel, and facilities. The system records quantifiable data and generates various reports. The data are available to all management personnel, and each administrator is provided with a form for periodic evaluation of the available data, including recommendations to improve the data or method of reporting.

AIDS is a manual operation, but the data can be computerized without difficulty. New segments may be developed and added as desired. The system is designed to be maintained by clerical personnel, and a manual setting forth the reporting procedures for each unit of the university is available.

AIDS is a systematic endeavor to facilitate the collection and utilization of useful operating data. Thereby, administrators are encouraged to develop new management skills based upon the amount and quality of information available to them. Each administrator can determine what his or her information requirements might be and then use these data in decision-making, planning, and control. Since this particular information system does not make use of a computer for processing data, it involves a minimum expenditure of time, space, personnel, and funds.

**MARK IV**

MARK IV is a general purpose software computer program suitable for college and university use. It has been developed as a proprietary product by Informatics/Software Products Company, with sales offices located in Los Angeles, Chicago, New York, and Washington. Descriptive brochures present essential features of the system.

MARK IV is a system which facilitates file definition, organization, maintenance, scanning, and selection of data. It arranges and sorts available data, summarizes information, and provides reports according to various specifications. The outputs include paychecks, labels, invoices, journal entries, and similar records. The educational applications of the system include student records, central stores inventory, alumni records, faculty personnel data, payroll preparation, class scheduling, student registration, accounting, and library cataloguing. In addition to the usual processing tasks, the system stores data for later access. It is possible to obtain reports directly from inquiry, without special programming.

There are plans for future improvements and development of the system. An on-line capability for immediate interaction between user and computer was expected to be added to the system late in 1972. A method for reducing computer time was also to be available by the end of 1972.

MARK IV is designed to operate with computers of the IBM 360 or 370 series and with the Univac Series 70 computers, with either the standard disk operating system or the tape-disk operating system. Company support of the system includes installation, training of personnel, technical consultation, and continuing maintenance.

The developers claim that the system is simple enough to permit nontechnical personnel to learn about and use most of the system's capabilities within a few hours. A few days of instruction should permit experienced data processing personnel fully to utilize the system. Operating and reference manuals are available, and a monthly newsletter assists owners of MARK IV. A group of users meets twice yearly to compare experiences and to share new applications.

Reportedly, as of early 1972, there were about 450 installations of MARK IV, including some 20 colleges and universities. MARK IV is not a data based management information system but a computer program for using, maintaining, and developing current data files. It would appear to be best suited for use by an institution which already has a substantial data processing operation and desires to obtain improved access to and analysis of information already being maintained. The price of the basic system in 1972 was about $12,000 for a college or university. Additional charges are made for training and other services.

**National Center for Higher Education Management Systems (NCHEMS)**

The National Center for Higher Education Management Systems is an outgrowth of work undertaken initially by the Western Interstate Commission for Higher Education. The National Center has been largely financed by the Office of Education of the United States Department of Health, Education, and Welfare.

The National Center has undertaken to develop a program planning and budgeting system which might be used by an individual college or university, by a state system of higher education, or even by the federal government if such use should become desirable. An elaborate and detailed series of technical papers has been published setting forth the various components of the system.

The first building block of the NCHEMS planning and budgeting system is a data elements dictionary. This provides common or uniform definitions of the desired data organized by such general categories as students, staffing, facilities, and expenditures. The data elements dictionary and other parts of the system may be employed solely for the purpose of providing historical statistical information about the operations of a college or university. In addition, the historical data may also be used in planning future operations.

The second building block is a program classification structure. This provides a standard set of categories for outlining the various program activities of an institution: instruction, research, public service, academic support, student services (including student aid), institutional support, and institutional operations. These program categories are expected to be the cost centers for calculating program costs and for preparing program budgets. The data elements dictionary and the program classification structure could provide a uniform set of data which would permit inter-institutional comparisons of expenditure experience. Cost comparisons would be possible by departments, by course levels, by degrees granted, and by other measurements.

In addition to cost comparisons, and it is recognized that such comparisons will require extensive data analysis to ensure common data elements, the NCHEMS system hopes to develop program outcome indicators beyond degrees and credit hours and in terms of personal and social value.

This procedure would be essential in developing true cost-benefit analysis. The feasibility of such a procedure, however, is remote at the present time, due to the difficulty of defining and measuring educational progress and fulfillment.

A complicated and complicating part of the NCHEMS system is the course load matrix. This procedure identifies courses taken by students outside their major fields. The matrix seeks to develop data on a program basis which will indicate cross registrations among departments. Thus, instructional program costs represent the cost of majors or of degree enrollments rather than simply of course enrollments. Apparently, this step in the cost analysis is not essential to the entire procedure if an institution or system desires to omit it. At the same time, of course, such omission could result in the non-comparability of reported data.

The cost analysis (cost estimation model) requires a calculation of the direct expenditures of each department, including faculty salaries, staffing salaries, supplies and equipment, travel, and other items. Such direct expenditures must also be determined for the various supporting offices and units of the college and university. To arrive at a total program cost, on either a per credit hour basis or a per full-time student basis, the support costs must be allocated to the instructional cost centers. The basis of such allocation has been under study and no particular procedure had been recommended as of the end of 1972.

Models for a student flow projection and a resource requirements prediction have also been developed by NCHEMS, and application of these procedures has been undertaken in several institutional settings.

Further, NCHEMS has developed a faculty activity analysis in order to divide salary costs among instruction, research, public service, and other programs. In addition, there are a personnel classification manual, a space analysis manual, and other documents. The extent to which these and other manuals would require extensive additional data collecting by a college or university can only be determined through field testing.

NCHEMS has been primarily concerned with providing a uniform or common procedure for data collection, storage, and analysis. It has not been involved in developing computer programs for all these efforts. Late in 1972, NCHEMS did provide a computerized program for applying its resource requirements prediction model. The program could accommodate up to 200 departments and 200 degree programs; it could also accommodate seven course levels, six faculty ranks, four groupings of operating staff, five kinds of instructional expenditure, and seven kinds of other departmental expenditure. A computer program was also available for the induced course load matrix.

The NCHEMS data collection and analysis system may be the most comprehensive undertaken in the United States. It should be noted, however, that there is some concern about the costs which may be entailed in the application of the system and additional concern about the use which may be made of the data which the system is intended to yield. Some

critics feel that the system may be more valuable as a basis for state and federal, rather than institutional information on needs.

It must also be emphasized that NCHEMS is not intended to provide colleges and universities with a computer program for data collection and storage for use in daily operations. Rather, the NCHEMS publications set forth standard or uniform categories and procedures for the collection and analysis of data for planning. The NCHEMS system also assumes a considerable sophistication within a college or university in data collection, processing, and reporting. These endeavors obviously cannot be undertaken without access to medium or large-sized computer equipment.

NCHEMS has hoped to obtain financing for a Small College Demonstration Project (SCDP) which would permit the field testing of the data elements within a college environment. The various data element dictionaries (student, staff, facilities, course, and finance related elements), the program classification structure, the resource requirements prediction model, the student flow model, the faculty activity analysis, the cost finding principles, the personnel classification manual, and the space analysis manual would all be subject to modification, presumably in terms of the circumstances and information resources of small colleges. As of early 1973, full financing for this project had not been obtained, but several schools have procured funds to implement the system under the direction of the NCHEMS staff. In addition, several other institutions are participating without financial support.

NCHEMS also offers an extensive information and training program to acquaint college and university personnel with the purposes, usefulness, and rationale of the system.

### Comprehensive Analytical Methods for Planning in University Systems (CAMPUS)

CAMPUS is a systems model for college and university planning developed by the Systems Research Group based in Toronto, Canada. CAMPUS has gone through several stages of modification since it was first announced in 1965. And there have been several experiments with the system by American colleges and universities, some of which have been financed in part by the Exxon Education Foundation.

CAMPUS is an integrated, data based planning system. The data are organized according to the NCHEMS program classification structure, which is complex, but NCHEMS compatible. The input includes data on programs, students, staff, space, equipment, and finances. The system makes use of these data which presumably are already available within a college or university.

Incorporated into the system is a computer simulation function. It can be used to generate multi-year, annual, or semester reports; past, current, or future; detailed or general. A special feature is that the mathematical relationship of different variables can be determined by the user. Those who have made use of CAMPUS have found helpful the procedures which

enable current decisions and approved future plans to be incorporated in the output. The system can be used for program budget purposes and to relate costs to future levels of program activity.

At one college, it took eighteen months to implement the operation of CAMPUS; much of this time was spent in organizing and collecting the required input data. Shorter start-up periods have been reported and could be expected if extensive data systems were already in existence and a truncated model were used. It was also found that CAMPUS was useful in encouraging faculty members and department heads to participate. The simulation model provided data about the future resource requirements and cost implications of the policy and program decisions.

CAMPUS requires, in addition to substantial data inputs, access to computer equipment in order to make the necessary computations and to provide the output information. The costs of the system depend upon the availability of data. In one instance, it was found that one full-time person was able to maintain the data base and operate the simulation model.

### System for Evaluating Alternative Resource Commitments in Higher Education (SEARCH)

SEARCH is a systems model originally developed for an eight college consortium by Peat, Marwick, Mitchell and Co. The system is also referred to as Computer Assisted Planning for Small Colleges (CAP: SC). Approximately one half of the development cost was provided by the Educational Facilities Laboratory, the Exxon Education Foundation, the Kettering Foundation, and the Standard Oil of Indiana Foundation.

SEARCH assumes that a college is an interactive system. Based upon a mathematical simulation model, SEARCH explores the magnitudes of alternative policy decisions or alternatives in the environment. Statistics on students, programs, faculty, facilities, and finances over time are used as a basis from which to project future data by yearly intervals up to ten years. One or more of the variables may be held constant or given different values, in order to simulate alternative magnitudes.

The model is flexible enough to permit use by colleges of various sizes and characteristics. The amount of detail incorporated in the simulated model can be varied according to the needs of the individual institution. The projections can be designed to suit the interests or concerns of the participants in the planning process, with the print-outs providing data on enrollment, programs, facilities, personnel, and finances.

The model has been designed primarily for use on large computers on a time-sharing basis. It is intended to be used with on-campus remote terminals. In this way, the capability of a large computer can be utilized at relatively low cost, the cost of rental of the terminal equipment and of shared time of a central computer facility. In addition, the program can be run in a batch-processing mode at a computer center, with the report then transported to the college.

SEARCH can be used directly by a college administrator without the assistance of technical personnel. The cost of implementation will be determined by the amount of detail desired in the simulation model, and, more importantly, by the availability of data about previous experience. The computer program itself is in the public domain; a new user need pay only for the manuals. Peat, Marwick, Mitchell and Co. do charge a consulting fee to assist in the implementation of the program, but, as stated earlier, hardware costs tend to be fairly low.

**Higher Education Long-Range Planning/Planning Translator (HELP/PLANTRAN)**

The HELP/PLANTRAN system was developed by the Midwest Research Institute, at the request of the Kansas City Regional Council of Higher Education. The system has been used by the fourteen institutions of the Council, which range in size from the several thousand students of the University of Missouri at Kansas City to the Kansas City Art Institute with only a few hundred students.

The HELP/PLANTRAN system includes a program and a consulting service to work with administrators of an institution to determine the important elements to be considered in planning for the college or university. The mathematical relationships must be determined for these components. Computer processing then provides a report or print-out of the logical consequences over a ten year period from the variables which have been set forth in the data. No actual simulation model is employed, but a separate program is developed for each institution. The system is designed for developing an individual model responding to the particular circumstances and assumptions of the individual institution.

In practice, the number of assumptions and variables utilized by various institutions in the Kansas City area has ranged from forty to over two hundred. The variables have included different quantities for tuition charges, enrollment, student-faculty ratios, endowment income, salaries, space utilization, etc.

While there is maximum flexibility in this approach to planning, there is also an inherent weakness. The component elements and the equations of any one model are only as detailed as the consultants and the administrators make them in each application. These details may not be as extensive or involve as many different variables as are provided in other models developed for college and university planning. The fact that faculty and administrators of the individual institutions have participated in determining the assumptions and variables to be included, however, does tend to give them greater confidence in the results produced by the exercise.

The procedures required for installation of this approach are relatively simple. If the data about previous operations are readily available, a program can be worked out within a short period of time. The simulations can be obtained by administrators on remote terminals connected to a central processing unit. The direct costs for the system, consultant assis-

tance in design, and the training of administrators to use the system amount to $7,500.

### Cost Estimation Model (CEM)

CEM was developed by the National Center for Higher Education Management Systems as a computerized training version of the Resource Requirements Prediction Model. The purpose of this model is to provide an actual system for translating the data elements of NCHEMS into a computerized systems model to be used by a college or university. The various recommended data elements can then be organized and utilized for planning.

The model is suitable for projecting unit costs for instruction and for aggregating five-year budget forecasts. These results can then be tested in terms of enrollment projections and variations in academic policies. Such matters as admission policies, program offerings, teaching loads, class size, and faculty requirements can be investigated.

The model has been made widely available through training seminars of NCHEMS and can be applied by any college or university with the use of such technical or consulting service as it has available to it. The system requires access to a computer. Under ideal circumstances—an extensive existing data base in an institution and a staff of competent technical personnel—the model can be installed and utilized in a short space of time at relatively low additional cost.

### TEMPLAN

TEMPLAN is a system developed at Temple University in Philadelphia, to assist the university administration in its planning and budgeting operations. Outside consultants assisted in formulating the necessary computer program.

The system is a relatively simple model suitable for simulating the annual incremental effect of trends and of various assumptions about future conditions and policies. Prior to the development of TEMPLAN, statistical data utilized in administrative decision-making were maintained in different formats at separate places within the University. Four categories of data were brought together and incorporated in the model: (1) enrollment, (2) faculty, (3) income, and (4) expenditures. These categories were subdivided into the various component parts customarily employed in the Temple University budget.

The system can function in two ways. It can project for a given number of years changes in any one or all of the four categories according to any specific assumption, such as a straight-line projection of enrollment increases of 5 percent per year. Or, a projected goal, such as a balanced budget based upon increases in tuition income, can be specified for five years in the future, and the incremented steps year by year backward from that goal can be computed for each of the four categories.

One of the primary purposes of TEMPLAN is to make it an analytical tool also accessible to others outside the central administrative staff. Thus, the deans of the various colleges can seek their own projections as they desire. The system is also well suited to an institution which is not operating a sophisticated management information system (on the scale and complexity, for example, envisaged by NCHEMS).

The model requires access to a large computer. This has been achieved by means of remote terminals located at various points within the University and connected to the computer center. In addition to computer printouts, the University is developing a computer generated histogram in order to provide data in an easily understood form. It seems probable that TEMPLAN could be applied to other institutions.

**Planning, Budgeting and Accounting Manual for Colleges (NACUBO)**

In 1970, the National Association of College and University Business Officers published a Planning, Budgeting and Accounting Manual for colleges. This manual was developed by Peat, Marwick, Mitchell and Co., under the joint direction of Howard University and Southern University and financed by the Ford Foundation. Initially, the manual was designed and used in a series of special workshops for predominantly black colleges. Subsequently, the manual has been made available to colleges and universities generally. By 1972, over 600 administrative officers representing more than 360 colleges had participated in workshops explaining the use of the manual. This training effort is continuing in 1973 under the auspices of both the National Association of College and University Business Officers and the Council for the Advancement of Small Colleges.

It must be emphasized that the NACUBO manual is not a computerized program. Rather, it is a procedural handbook or guide to a planning and budgeting process, entitled the Program Planning Cycle. The manual envisages a continuing process within a college or university of reviewing institutional policies, objectives and programs, and the costs of educational and supporting programs, for one, two, and five-year projections of expense and income.

The manual outlines a program planning process requiring a planning team within the administration of a college and an analytical studies group representing administration, faculty, and students. This latter group is expected to conduct a critical analysis of college programs and costs in order to make recommendations for resource allocations. Appropriate forms for data collection and distribution are suggested, and illustrated charts of the process are provided in the manual. The manual sets forth in considerable detail the basic documents and summary records to be handled in the implementation of program and budget plans.

The NACUBO process is intended to achieve a careful and rational basis for budget preparation within a college involving faculty and student participation. Necessary data are provided about faculty and staff needs and the scope of supporting programs required to serve the instructional pro-

gram. As a consequence of this procedure, all parts of the academic community should obtain a clear and detailed understanding of the financial needs of a college. Two or three colleges, such as Lawrence University in Wisconsin, have made extensive use of the NACUBO manual and have demonstrated in practice the utility of the procedure.

The NACUBO manual perhaps sets forth a more traditional budget planning process than that involved in computer simulation. At the same time, in the absence of the kind of experience outlined in the NACUBO manual, a college or university might be well advised to adopt these procedures before undertaking the more sophisticated techniques of electronic model simulation. The advantages would be the orientation of faculty and students to the decision-making process and the reality of institutional budgets, the experience of faculty and student involvement along with administrators in the budget process, and some familiarity with the impact of institutional policies and objectives upon institutional costs. Moreover, the collection of the data envisaged by the NACUBO manual would be an essential first step before more sophisticated long-range planning procedures were attempted.

**College and University Planning/American Foundation for Management Research (CUP/AFMR)**

Colgate University and the American Foundation for Management Research have cooperated in the development of a planning process for private, medium sized, liberal arts colleges. The AFMR Management Learning Center is located in Hamilton, New York.

The purpose of the process is to systematize and formalize the planning process of a college. The factors and variables in planning are organized and structured in such a way as to require careful, systematic attention. The planning process is divided into three phases: (1) definition of the underlying philosophy and purpose of the institution, (2) enumeration of the current resources of the institution and of the data utilized in current decision-making and organization of quantitative data about the institution and its environment, and (3) identification of the gaps between philosophy and purpose and resources of the institutions, especially as past trends are projected into the future. The first and third phases take a week each and are carried out by administrative personnel in seminars held in the AFMR Management Learning Center. The second phase may require several months to complete, depending upon the availability of the needed quantitative data. The process includes a specific schedule for follow-through, review, and approval of plans by various faculty and other committees, culminating in action by the board of trustees.

The AFMR Management Learning Center has an extensive library of planning literature, including manuals and other instructional materials. A professional planning consultant or resource person is a necessary adjunct to a planning seminar. The process is intended to develop a systematic attitude toward planning among all the participants. The president of a

college and his or her principal administrative associates are the key figures to be involved in this planning process. The American Foundation for Management Research, on a consulting fee basis, helps to develop this planning process for a particular college.

**Administrative and Organizational Systems/National Laboratory for Higher Education (AOS/NLHE)**

The National Laboratory for Higher Education, in North Carolina, has also directed its efforts toward the creation of concepts and techniques related to systematic management and planning in colleges and universities. The Laboratory approach emphasizes two objectives: (1) to assist in particular the smaller institutions and (2) to individualize assistance oriented to the needs of a particular institution. Funded by the Office of Education, the Laboratory is an independent, non-profit corporation.

The National Laboratory for Higher Education has produced a variety of products to assist a college or university in its management and planning. These include:

1. **Management Planning Guide**, a procedural kit with a manual containing forms and procedures for planning and management. These materials were field tested in the summer of 1972.
2. **Institutional Goals Package**, a set of questionnaires, forms, item cards, and procedures for reaching consensus on institutional goals.
3. **Deriving Measurable Objectives**, a manual demonstrating how to convert broad goals into specific and quantifiable objectives.
4. **Educational Development Officer Training Program**, an in-service training program to be used within an institution to prepare persons for carrying out planning assignments.
5. **The NLHE Information System**, a generalized information storage and retrieval system for use with small-scale computers, with two manuals (a Logic Manual and a User's Guide), and a set of keypunched computer cards. (This system has been used particularly for admissions records, registration, student records, fund-raising, and library cataloguing).

Other products, still in the process of development, include manuals on the comparative evaluation of data management systems, statistical interface systems, an institutional fact book, and an institutional research survey.

Most of the techniques developed by the National Laboratory were still in the field test stage as of 1972 and were not yet generally available for implementation. One exception was the Information System, which is available at the cost of reproduction and mailing. It is reported that it has been installed in over 200 colleges. The Laboratory plans to conduct seminars, workshops, and training programs and to provide consultants to

assist in the installation of the Laboratory's products at individual colleges.

Because the NLHE has been funded by the federal government, its products are in the public domain. The only charges to institutions who desire to use the products are for printing, training, and consultative services.

### College and University Systems Exchange (CAUSE)

College and University Systems Exchange is a professional organization of college and university personnel, established to promote the exchange of information about computer programs and to undertake training and implementation services related to computer programs. The national headquarters opened on September 1, 1971, in Boulder, Colorado.

CAUSE has set up six divisions with persons drawn from its membership concerned with applications systems exchange, information systems development, installation management, hardware and software systems, professional development, and small computer users. CAUSE hopes to prepare directories of systems personnel and hardware, a library of systems and programs, and monographs on exemplary systems, as well as to conduct educational seminars and conferences.

Membership in CAUSE is by institution; that is, by individual colleges and universities who agree to provide information about developed systems. Membership fees are based upon student enrollment and range from $100 to $1,000. Each member institution has one vote and one official representative, but mailings may be sent to three other persons within the institution.

CAUSE is not a system, but a promising new organization for the exchange of information about systems and perhaps even an exchange of programs where these are in the public domain. The potential of this organization for service to colleges and universities is substantial.

## Conclusion

It must be evident from this listing that a considerable amount of thought, effort, and funds have been devoted to the development of procedures and systems to improve higher education management. Indeed, it is a problem for college and university administrators today to decide what particular existing procedures may be best adapted to the circumstances of a particular college and most useful for internal management.

A chart (Figure 1) has been prepared to summarize a comparison of the various functions performed by the models, programs, and services identified for use in small colleges. The chart is also intended to express the overlap of functions of the several approaches, even though they are categorized according to emphases.

In general, it is evident that the various procedures catalogued herein serve two primary purposes. One purpose is to improve the management of data about the current operations of an institution. It is essential that

data collection within an institution be accurate, comprehensive, timely, and useful for decision-making. The second purpose is to provide means for forward planning of college and university operations. Too often students, faculty, and administrative officers have been inclined to think that tomorrow will take care of itself. But it is even more likely that tomorrow may bring disaster if preparations for it have been neglected.

No information system and no planning system can achieve miracles, or be a substitute for decision-making. But today we assume that an informed and considered decision will be more acceptable in our society and will be more beneficial than an uninformed, hurried, and arbitrary determination. To encourage that informed and considered decision, information and planning systems have been devised.

**FUNCTIONS PERFORMED BY SYSTEMS DESCRIBED IN THIS STUDY**

**Figure 1**

| Models, Programs and Services | Functions: Management Information System for Operations | Management Information System for Planning | Interinstitutional Comparisons | PPBS | C/B | Simulation | Goal Setting Techniques | PERT–like Processes | Information Service |
|---|---|---|---|---|---|---|---|---|---|
| INFO/OASIS | X | | | | | | | | |
| TOTAL | X | | | | | | | | |
| AIDS | X | | | | | | | X | |
| MARK IV | X | | | | | | | | |
| PMS/NCHEMS | | X | X | X | X | X | | | |
| CAMPUS | | X | X | X | X | X | | X | |
| CAP: SC (SEARCH) | | | | | | X | | | |
| HELP/PLANTRAN | | | | | | X | | | |
| CEM/NCHEMS | | | | | | X | | | |
| TEMPLAN | | | | | | X | | | |
| PBA/NACUBO | | X | | X | | | | X | |
| CUP | | X | | | | | | X | |
| AOS/NLHE | X | X | | X | | | X | X | |
| CAUSE | | | | | | | | | X |

## FOR FURTHER INFORMATION

Requests for further details on each system may best be answered by the individual developers or utilizers of the models, listed alphabetically by program below. For more information about Dr. Shoemaker's study, please contact the Council for the Advancement of Small Colleges, One Dupont Circle, N.W., Suite 750, Washington, D.C. 20036.

AIDS
Administrative Information Distribution System
Portland State University
Portland, Oregon 97207

AOS/NLHE
Administrative and Organizational Systems
National Laboratory for Higher Education
Senior College Division
Mutual Plaza
Durham, North Carolina 27701

CAMPUS
Comprehensive Analytical Models for Planning in University Systems
Systems Research Group
252 Bloor Street West
Toronto 5, Ontario, Canada

CAUSE
College and University Systems Exchange
737 Twenty-Ninth Street
Boulder, Colorado 80303

CEM
Cost Estimation Model
National Center for Higher Education Management Systems
Post Office Drawer P
Boulder, Colorado 80302

CUP/AFMR
College and University Planning/American Foundation for Management Research
Colgate University
AFMR Management Learning Center
Hamilton, New York 13346

HELP/PLANTRAN
Higher Education Long-Range Planning/Planning Translator
Midwest Research Institute
425 Volker Boulevard
Kansas City, Missouri 64110

MARK IV
Informatics/Software Products Company
21050 Vanowen Street
Canoga Park, California 91303

NACUBO
Planning, Budgeting and Accounting Manual
One Dupont Circle, N.W.
Suite 510
Washington, D.C. 20036

NCHEMS
National Center for Higher Education Management Systems
Western Interstate Commission for Higher Education
Post Office Drawer P
Boulder, Colorado 80302

OASIS
On-Line Administrative Information System
Project INFO
Encina Hall
Room 30
Stanford University
Stanford, California 94305

SEARCH
System for Evaluating Alternative Resource Commitments in Higher Education
Peat, Marwick, Mitchell and Company
345 Park Avenue
New York, New York 10022

TEMPLAN
Temple University
Philadelphia, Pennsylvania 19122

TOTAL
CINCOM Systems
2181 Victory Parkway
Cincinnati, Ohio 45206

**Other Systems Models:**

EDANAL
Inner City Fund
1828 L Street, N.W.
Washington, D.C. 20036

HEPS
Higher Education Planning System
CUNY Brooklyn College
Brooklyn, New York 11210

INSITE
Institutional Space Inventory Techniques
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

SPACE
Space Planning and Cost Estimating System
University of California
Office of Analytical Studies
Center for Research in Management Science
2288 Fulton Street
Berkeley, California 94720

## MANAGEMENT DIVISION PUBLICATIONS

BY 1990: DOUBLED ENROLLMENTS, TRIPLED COSTS. Charts showing the chronic financial squeeze with which most urban universities will have to learn to live.

MEETING THE FINANCIAL PINCH AT ONE UNIVERSITY. The university is Princeton; the saving—one million dollars—reflects the impact of Provost William Bowen's incisive memorandum explaining why the University needed to tighten its belt.

BLACK STUDIES: HOW IT WORKS AT TEN UNIVERSITIES. After the ideological furor dies down, there are these management problems to solve: organization, faculty, money.

319 WAYS COLLEGES AND UNIVERSITIES ARE MEETING THE FINANCIAL PINCH. An expanded check-list of practices being used right now to save money and increase income.

THE ADVANTAGES OF WORK-STUDY PLANS. In addition to helping balance a university budget, work-study can attract capable students who need a chance to earn their way, and make education more relevant for all students.

SURVIVAL THROUGH CHANGE. A case study of a privately supported urban university's plan to fight the budget squeeze.

A GUIDE TO PROFESSIONAL DEVELOPMENT OPPORTUNITIES FOR COLLEGE AND UNIVERSITY ADMINISTRATORS. Third expanded edition of a handbook identifying over 125 useful workshops, conferences, internships and fellowships scheduled for 1973.

RESCUE BEGINS AT HOME. Highlights of *To Turn the Tide* (Father Paul C. Reinert, President of St. Louis University), including an 11 - point self-help plan other institutions can follow.

PUTTING COOPERATION TO WORK. A survey of how voluntary cooperation is helping colleges and universities.

PERSONNEL MANAGEMENT IN HIGHER EDUCATION. Three papers discussing general scope and problems, focusing on the current issues of tenure and collective bargaining, and suggesting ways to decrease costs.

HIGHER EDUCATION WITH FEWER TEACHERS. A survey of colleges and universities which have recently increased their student-faculty ratio to 20 to 1 or more, for those who are considering such a change and wondering how class size affects quality.

THE CONTRIBUTIONS OF BUSINESS MANAGEMENT TO HIGHER EDUCATION MANAGEMENT. Report of a seminar, in which higher education administrators learned from business experience without losing sight of differences between the two institutions.

FINANCING CURRENT OPERATIONS OF AMERICAN HIGHER EDUCATION. An analytical framework for comparing and contrasting the income and expenditures of publicly and privately supported colleges and universities.

ALTERNATIVES IN STATE GOVERNMENT FINANCING OF HIGHER EDUCATION. A description and comparison of various state approaches to the financing of students and institutions and the problems and policy decisions confronting them.

Single copies of each publication are free.

There will be charges for quantity orders of most publications. We will be pleased to provide, at your request, information on these charges.

The Academy for Educational Development, Inc., is a nonprofit tax-exempt planning organization which pioneered in the field of long-range planning for colleges, universities, and state systems of higher education. It has conducted over 100 major studies for institutions throughout the country, as well as for national agencies such as the U.S. Office of Education, the National Science Foundation, the Agency for International Development, and the National Institutes of Health. Additional information regarding the Academy's complete program of services to education may be obtained from its offices:


*New York:*
680 Fifth Avenue
New York, N.Y. 10019
(212) 265-3350

*Chicago:*
LaSalle Hotel, Suite 222
10 N. LaSalle Street
Chicago, Illinois 60602
(312) 996-2620

*Washington:*
1424 Sixteenth St., N.W.
Washington, D.C. 20036
(202) 265-5576

*Palo Alto:*
770 Welch Road
Palo Alto, California 94304
(415) 327-2270

*Akron:*
55 Fir Hill
Akron, Ohio 44304
(216) 434-2414 or 253-8225


The Academy's Management Division was established in 1970, under grants primarily from the W.K. Kellogg Foundation, to help college and university presidents and other officials improve the administration of the nation's institutions of higher learning. To achieve this purpose, the Management Division conducts research, publishes the results, and organizes conferences and professional development programs.

*For further information about the Management Division, write or call:*


Management Division
Academy for Educational Development, Inc.
1424 Sixteenth Street, N. W.
Washington, D.C. 20036
(202) 265-5576


Single copies of this publication are available from the Academy at no charge.